

§29. Study on Tritium Behavior in Liquid Blanket System of Laser Inertial Fusion Reactor

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In designing of the liquid blanket system for a laser inertial fusion reactor, it is necessary to have the efficient tritium recovery system for assurance of tritium self-supply and to have the tritium safety confinement system for certification of the tritium radiation safety.

It is required to know the tritium transfer properties in liquid breeder materials because the wetted wall system is considered to protect the first wall in design of the inertial fusion reactor of Osaka University. At present, use of Lithium Lead is considered as the breeder material though only a small amount of reports have been made on tritium transfer properties. It is anticipated that a large part of the bred tritium may permeate to the outer circumstances because the solubility of hydrogen in lithium lead is considered to be so small. Accordingly, the object of the present researchers is to make the measurement of tritium diffusivity and solubility in lithium lead and lithium as a part of the cooperative research program lead by the Institute of Laser Engineering, Osaka University.

The following advancements are made in this year.

- 1) Tritium diffusivity and solubility in lithium are preparatory measured using a U type tube reactor and the data in this study are compared with data reported by Alire or Moriyama et al. The diffusivity in this study agrees with the tendency of equation reported by Alire.
- 2) The experimental apparatus as shown in Fig. 1 is made in a glove box so that the experiment using tritium is also capable. In experiment, temperature, gas flow rate to the both gas flow channel, concentration of hydrogen isotopes added to the both channel, thickness of liquid breeder are variable parameters.
- 3) Solubility and diffusivity of hydrogen in FLiNaK are preparatory observed in this year and it is concluded that the apparatus shown in Fig. 1 can give a reliable results. The similar apparatus is made by the present researchers in the Idaho National Environmental Laboratory to measure the tritium transfer properties in FLiBe, and good results are obtained so far.
- 4) The tritium release behavior from solid breeder blanket materials are also performed as a part of this cooperative research works because use of a solid breeder in a inertial confinement is not fully abandoned yet. It is assured in this study that not a little amount of bred tritium is released as the chemical form of HTO from most solid breeder materials even when hydrogen is mixed to the blanket purge gas. The fact that both HT and HTO are released

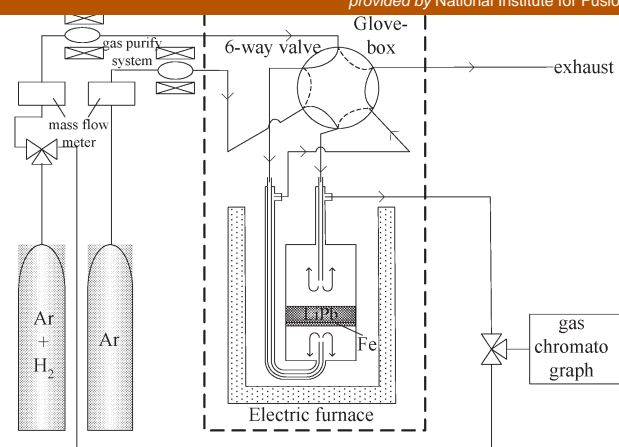


Fig. 1. Experimental apparatus made by present researchers for measurement of tritium transfer properties in liquid breeder materials.

makes it difficult to recover whole bred tritium. It is also anticipated that a part of tritium in HT form will be transferred to the cooling water for electricity after permeation through the wall material of cooling devices.

Therefore, more research is required to understand the tritium behavior to assure tritium self-supply together with certification of tritium safety for liquid and solid blanket system.

References

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